Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/835
CZECHOSLOVAKIA
February 1964
Submitted in:
FRENCH and RUSSIAN

Confidential until official release during Conference

Abstract

A SYSTEM FOR ACCURATE AUTOMATIC LOCATION OF FUEL ELEMENT CHARGING MACHINERY

J. Havel and M. Kondr

In the case described the charging machine makes it possible to change fuel elements whilst the reactor is operating at full load. In view of the need for protection against the high-intensity gamma radiation, it is of very heavy construction (250 tons, including the travelling crane).

The machine has to move over the reactor, over the fuel element cooling space, and over the spent and fresh fuel element store.

The track of the travelling crane is approximately 60 m in length and the tolerances for the alignment of the axis of the machine are very fine, especially over the reactor. The total deviation from the axis of the fuel-element channel may not exceed $\pm$ 0.5 mm, so that errors in the positioning of the crane track may not exceed $\pm$ 0.35 mm.

To achieve this accuracy the rate of movement of the machine must be low, although a greater speed is called for when it has to move over long distances. In order to meet these two requirements, a speed of 10 m/min has been chosen for long distances and 15 mm/min for the final accurate positioning.

In order to simplify the entire element-changing process as much as possible, a system has been devised for the automatic positioning and accurate centring of the machine. The co-ordinates are selected by means of a system of selsyns, the signal from which controls the driving motor switches of the machine through stops and triggers. The motors bring the machine rapidly towards the selected channel. At a certain point close to the final position, the signal from the selsyns is automatically replaced by that from a photo-electric system which ensures slow, precise location of the machine on the axis of the selected channel.

The advantage of this system lies in the fact that the signal from the photo-electric system is derived from a reflecting marker located at the end of the channel.

Accurate centring is therefore guaranteed, even if the axis of the channel deviates from its proper co-ordinates under the effects of temperature or of fabrication or other deformations. The photo-electric transducers, which are very small, are incorporated in an optical system which makes it possible to check the accuracy of location by direct observation of the reflecting marker or by closed-circuit television.

The entire system requires a relatively small number of connections between the operating point and the machine, since handling is very simple whether carried out manually or automatically.

As the photo-electric system signal is derived from the narrow edges of the image of the reflecting marker, most of the marker surface is free for observation and continuous control of the operation.

The operator controls the machine from his post by means of the selsyns and closed-circuit television.

Tests on a model installation have confirmed the reliability of the system.